AN APPLICATION FOR LETTERS OF PATENT

by

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A WATER-IN-OIL EMULSION FUEL

CROSS-REFERENCES TO RELATED APPLICATIONS

Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

REFERENCE TO A "MICROFICHE APPENDIX"

Not Applicable

BACKGROUND

Field of the Invention

The present invention relates to the field of fuel emulsions and in particular a novel water-in-diesel oil emulsion.

Description of the Related Art

With the global increase in the usage of engines and other devices that use carbonaceous fuels such as diesel fuel, especially in areas of new and developing economies of the world, there has been an increase in the amount of air borne pollution

caused by exhaust emissions resulting from the consumption of petroleum fuels used by such engines including compression ignited (diesel) engines, combustion turbines furnaces and steam boilers..

In the past, nations have imposed obligations on manufacturers and users of engines that use carbonaceous fuels to include costly pollution control devices and other measures designed and engineered into or placed upon the engines to burn fuel more efficiently and cleaner. Sometimes, these mandated pollution control devices breakdown exhaust emission into less harmful sub-components or act as filters that prevent the escape of harmful exhaust emissions. In all of these cases, these mandated pollution control devices, while undeniably beneficial, have come at great cost both to consumers , engine manufacturers, manufacturers who incorporate such devices into their equipment, and the petroleum industry which manufactures cleaner fuel formulations for use in internal combustion engines. Massive sums have been spent for research and development, testing and certification to design and implement pollution control measures for internal combustion engines and the fuels that they use. The costs for much of this comes from extensive redesigning and engineering of newer internal combustion engines which burn fuel more efficiently to obtain similar power from the same amount of fuel than did older internal combustion engines. This results in the engines becoming more complex and sophisticated than their predecessors for example the replacement of mechanically controlled to computer controlled engines

~~This can more easily be achieved by established countries with mature economies~~, growing nations and their respective governments, than poorer or developing nations whose economies and manufacturing bases, often lack sufficient financial resources, to afford the extremely costly intensive long term testing, research, implementation and compliance controls needed to effect and improve pollution reduction measures for internal combustion engines. ~~for~~ the costs of controlling or limiting air pollution can severely curtail ~~or damage~~ a developing economy if prematurely imposed upon its ~~industries whose well-being upon which the~~ developing nation relies for continued

economic well-being. The developing nation will either (1) have to rely upon and become dependent upon those devices and implements developed by established countries whose economies give them the financial wherewithal to indulge wide spread pollution control (2) prematurely impose upon that growing counties industrial base pollution control implementation, as required by many international treaties, that could crippling the country's economy, (3) seek and implement less costly and easily implemented pollution control technologies rather than those devices which are engineered for incorporation within the internal combustion engine and its subsystems.

One such alternative pollution reduction measure is operating internal combustion engines on an emulsified fuel. Emulsified fuels, which have been used since the 1960s, use a carbonaceous or petroleum derived fuel, such as diesel, gasoline, and the alike mixed in with a non-carbonaceous element such as water. Where the carbonaceous fuel is mixed with larger quantities of water, the emulsion formed is a water-based emulsion. When water is mixed into a larger quantity of carbonaceous fuel, the emulsion formed is a fuel-based emulsion. Water-based emulsions are a harder to implement as a pollution control measure because the internal combustion engine which runs on a water-base emulsion must be re-engineered to run on that type of emulsion. Water-based emulsions are corrosive to an engine's internal components, thus such emulsions require agents to enhance lubricity and to operate without significant power loss, the engine has to be modified to handle the large quantity of water present in the emulsion.

Oil-based emulsion fuels, on the other hand, generally do not require any substantial modification of the engine. Oil-based emulsion fuels are not considered to be anymore corrosive on engine parts or system than regular fuel. Further, due to the water being present during the combustion process, the resulting combustion emissions from emulsion fuels contain lesser amounts of harmful pollutants

Mixing an oil-type fuel with water is analogous to mixing water and oil in a salad dressing. A mixing agent or an emulsifier (i.e. vinegar) and some agitation is sufficient. These emulsifier(s) and their agents are also known as surfactants. Another example of

an emulsifying agent is soap which allows a grease, dirt, oil or hydrocarbon-based containments to form an emulsion with the rinsing water and be carried away. Another such example of an emulsion would be mayonnaise.

In the present field of water-in-oil emulsion (emulsion fuel) it is believed that once the water has been mixed into the fuel and the emulsifying agent or surfactants then coat the surface of water droplets to help stabilize the water droplet within the fuel. It is believed that this stabilization occurs in at least two ways, first the coating and interaction of the emulsifier on the surface of the water droplet helps the water droplet maintain its integrality and size. Second, the molecular interaction of the emulsifier on droplet causes the droplet to be repelled by similarly coated droplets, so it is hard for droplets to come together and form a large drop within the emulsion.

When correctly manufactured with the proper emulsifying agents, the droplets, through the fuel-water mixing process along with the action of the emulsifier(s), are of similar size and are well dispersed throughout the fuel.

After the creation of the emulsion fuel, the next problem faced by this field is that many emulsion fuels that lack long term stability in that they separate back into their individual constituents over time. The long term stability of a fuel emulsion, particularly for storage and transportation purposes, is particularly desirable. If separation occurs, engine performance generally suffers and where such stability can not be implemented, substantial modification to the engine, its fuel delivery and control systems are required to overcome the presence of a large quantities of separated water found in the emulsion fuel.

If a particular fuel-based emulsion is prone to separate, it can be formulated so that it only a minor or very limited separation of water and/or fuel from the fuel-based emulsion that is easily reversed back to a full fuel-based emulsion by mixing or agitating the product thus reverting to its original attributes. Some separation of this type is acceptable for use in internal combustion engines if it does not interfere with the combustion of the fuel on start up and running.

The pollution reducing capabilities of the emulsion fuel is though to be of several means. First, when hydrocarbonaceous fuel, such as petroleum, is combusted, it emits nitrogen oxides (NOx), a class of gaseous chemical which is an undesired and harmful pollutant. Second, when air, which contains approximately 80% Nitrogen (N_2), is combusted with petroleum or other carbonaceous fuels, the atmospheric Nitrogen also combusts to form large quantities of the NOx.. The higher the temperature of the carbonaceous fuel-air combustion, the larger the quantities of harmful pollutant NOx which are produced by the said combustion.

It is through the presence of the water in the emulsion fuel that temperature of the fuel emulsion combustion is lowered. It is believed that the combustion heat is absorbed by the water during its violent transformation into steam. When this occurs, the combustion of the emulsion fuel is kept at a lower temperate than the combustion of ordinary fuel. This lower combustion temperature of the emulsion fuel produces significantly lesser amounts of NOx emissions in the combustion exhaust gases. Additionally, the inherent stabilizing characteristics of the fuel emulsions are also believed to reduce the amount NOx emitted by the fuel-based emulsion itself (fuel emission). Further benefits are provided by the emulsifying agents in that they are essentially soaps (i.e. detergents) and in combination with the steam generated by the heat of emulsion fuel combustion, help clean the engine parts with which they come into contact.

It is further believed that the emulsion fuel obtains pollution emission reduction in the combustion exhaust by improving the efficiency of the actual combustion itself. It is thought that when droplets of ordinary fuel are sprayed into the combustion chamber of an internal combustion engine, it is only the surface of the droplets which is exposed to the air that burns during combustion. Therefore large droplets of ordinary fuel may not be fully burned during combustion and as a result leave the engine as smoke or fine particles called Particulate Matter (PM), a harmful exhaust emission. It is thought that when droplets of a emulsion fuel are sprayed into a combustion chamber, the violent

transformation of the water content to steam, shatters the fuel oil drop in its direct vicinity into much smaller fuel oil droplets having a much greater surface area in relation to its volume. The combination of greater surface area and the greater exposure to combustion air provides a far more complete and thorough combustion of the fuel oil, which is believed to cause the significant reductions in PM in emulsion fuels combustion.

There is therefore a need for a stable pollution reducing emulsion fuel that can be implemented using significantly less resources, both financial and engineering, than engineered design improvements to internal combustion engines and their associated systems.

SUMMARY OF THE INVENTION

~~The invention is a novel water-in-oil emulsion fuel substitute for~~ hydrocarbonaceous middle distillate fuels. The invention is comprised of a middle distillate fuel, water, mixture of fatty acids, ~~polyanhydride~~, and ammonium hydroxide. Additionally, ~~other fuel~~ quality enhancing agents can also be added to the emulsion fuel ~~as required.~~

It is an object of the present invention to provide a long term stabile water-in-oil fuel emulsion.

It is an object of the present invention to provide fuel emulsion that can be utilized in a wide variety of internal combustion engines without requiring any significant changes to the engine or any of its systems.

It is an object of the present invention to provide a water-in-oil emulsion fuel whose elemental make-up has the same or less detrimental health handling hazards as its base diesel oil.

It is an object of the present invention to provide a oil-in-water emulsion fuel whose additives can be economical and safely packaged in large quantities.

It is an object of the present invention to provide a water-in-oil emulsion fuel whose additives can be easily, economically, and safely combined with a wide variety of hydrocarbonaceous fuel to produce a stable fuel emulsion.

It is an object of the present invention to provide a water-in-oil emulsion fuel that can be made with a wide variety of hydrocarbonaceous middle distillate fuels to produce a stable fuel emulsion that has a reduced pollution emissions in the combustion exhaust as compared to the combustion of ordinary hydrocarbonaceous middle distillate fuels.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is a water-in-oil emulsion fuel that can act as a substitute fuel for those devices which combust middle distillate fuels. The invention can effect a reduction in Nitrogen Oxide (NOx) pollutant levels in the exhaust emission resulting from such middle distillate fuel combustion.

The term "middle distillate fuel" refers to that class of the hydrocarbonaceous fuel that is comprised in general of those mixtures of hydrocarbons which fall within the distillation range of about 160.0 degrees. to 370.0 degrees. C. These "middle distillate fuels" are named for the fact since they comprise the fraction which still distills after gasoline has been removed and distills before residuum (asphalt) during petroleum refining process. The residuum is the remaining portion of the crude oil that is left after gasoline and other distillates have been removed from it during refining. Middle distillate fuels include diesel fuels, burner fuels, kerosene, gas oils, jet fuels, and gas turbine engine fuels and alike.

MIDDLE DISTILLATE FUELS PROFILE

Distillate	Degrees F.	Degree C.
IBP*	250-500	121-260

10%	310-550	154-288
50%	350-600	177-316
90%	400-700	204-371
EP**	450-750	232-399

* Initial Boiling Point

** End Point

~~The invention combines water with the middle distillate fuel to form an water-in-~~ oil emulsion fuel that can be substituted for the middle distillate fuel combustion applications. Prior to combining the water with the middle distillate fuel, the water itself is filtered through reverse osmosis or other suitable filtration means to remove particulate and sediment contaminants that are naturally found in various degrees in water depending on its source. These containments need to be removed from the water to a satisfactory degree otherwise they will form deposits/build-ups on the internal workings of the devices that combust middle distillate fuels and well as present themselves as unacceptable pollutant emissions in the combustion exhaust.

The filtered water is added to the middle distillate fuel along with the additional additives of ammonia hydroxide, a fatty acid mixture and a polyanhydride. The preferred fatty acid mixture is technical grade oleic acid available from Ashland Chemical Company 2788 Glendale Milford Road, Cincinnati, Ohio USA under the name 213 OLEIC ACID TECHNICAL. The preferred polyanhydride is polyisobutylene succinic anhydride which can be procured from Chevron Oronite Company, under the Chevron Oronite LLC.'s label OLOA 371 or OLOA 213. OLOA 371 and OLOA 213 products are differentiated only on the basis that one label represents the paste form of the isobutylene succinic anhydride while the other label represents the liquid form of isobutylene succinic anhydride. Both forms of OLOA product can be used satisfactorily as ~~components of the invention.~~

The water, polyisobutylene succinic anhydride, ammonia hydroxide, and technical grade oleic acid are mixed to the middle distillate fuel to form the water-in oil emulsion fuel. In the preferred embodiment of the invention, it is found that best results occur when the middle distillate fuel is first mixed with the water and then the water-middle distillate fuel composition is mixed with polyisobutylene succinic anhydride, ammonia hydroxide, and technical grade oleic acid produces the best results in emulsion formation and stability. The mixture is then subject to pressure for final completion of the water-in-oil emulsion fuel.

~~It is believed that the~~ water-in-oil emulsion fuel reduces Nitrogen Oxides ~~(NOx)~~ emission levels in the combustion exhaust by lowering the temperature of the combustion air and the novel water-in-oil emulsion fuel below that needed to create significant quantities of Nitrogen Oxides that naturally occur with the combustion of middle distillate fuels. It is believed that the water present in the water-in-oil emulsion fuel under goes a phase change from water to steam during the combustion process. This resulting steam creates a "secondary atomization" of the fuel itself for greater efficiency in combusting the fuel.

The mixture ratio of the components of the invention is by weight percentage. The weight percentage of the middle distillate fuel to the invention is a range of 81% to 99.5%. The weight percentage of middle distillate fuel emulsification additive to the invention is 19.0% to 0.5%.

The mixture ratio of the components of the middle distillate fuel emulsification additive is by weight percentage. The weight percentage of water to the middle distillate fuel emulsification additive is a range of 0.0% to 25.0%. The weight percentage of ammonium hydroxide to middle distillate fuel emulsification additive is a range of 15.0%-20.0%. The weight percentage of a mixture of fatty acids to middle distillate fuel emulsification additive is a range of range 60%-70%. The weight percent of polyanhydride to middle distillate fuel emulsification additive is a range 3.0% to 10.0%.

Additionally, the fuel emulsion can contain additionally components selected from a group comprising of dispersants, corrosion inhibitors, antioxidants, anti-rust agents, detergents, and lubricity agent. These additional components are fuel enhancement agents and do not necessary effect the emulsion qualities of the emulsion fuel.

Although the present invention has been described with particular reference to certain preferred embodiments, variations, alterations, modification of the present invention maybe effected by one skilled in the art while remaining within the intent and scope of the following claims.